

INCH-POUND

MIL-DTL-18239E
w/AMENDMENT 1
25 November 2013
SUPERSEDING
MIL-DTL-18239E(AS)
31 October 2000

DETAIL SPECIFICATION

EARPHONE H-87B/U

Inactive for new design after November 25, 2013, may be used for replacement purposes.

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers one type of moving coil, dynamic type earphone designated as H-87B/U. This earphone transforms electrical energy into acoustical energy and may be acquired normally as component parts of a complete headset assembly. See 6.1, for information about use with cord assembly P/O H-87B/U, as specified in MIL-DTL-18266.

1.2 Classification. Earphones will be of the following types and Part or Identifying Numbers (PIN), as specified (see 6.2 b).

<u>Type</u>	<u>Figure</u>	<u>PIN</u>
1	1	M18239-1
2	2	M18239-2
4	3	M18239-4

Type 2 supersedes Type 3; items in stock may be used until exhausted.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

Comments, suggestions, or questions on this document should be addressed to: DLA-CC, DLA Land and Maritime, ATTN: VAI, P.O. Box 3990, Columbus, Ohio 43218-3990 or emailed to sound@dsc.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

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COMMERCIAL ITEM DESCRIPTION

- A-A-52024 - Compass, Magnetic: Surveyor's and Transit Pocket; with Optional Ball and Socket Joint or Ball and Socket Head, and Jacob's Staff

DEPARTMENT OF DEFENSE SPECIFICATIONS

- MIL-DTL-5002 - Surface Treatments and Inorganic Coatings for Metal Surfaces of Weapons Systems
- MIL-E-5400 - Electronic Equipment, Aerospace, General Specification for (Inactive for New Design)
- MIL-DTL-14072 - Finishes for Ground Electronic Equipment
- MIL-DTL-18307 - Nomenclature and Identification for Aeronautical Systems Including Joint Electronics Type Designated Systems & Associated Support Systems
- MIL-I-24768/13 - Insulation, Plastic, Laminated, Thermosetting, Cotton-Fabric-Base, Phenolic-Resin (FEB)

DEPARTMENT OF DEFENSE STANDARD

- MIL-STD-202 - Electronic and Electrical Components, Parts, Test Methods For

(Copies of these documents are available online at <http://quicksearch.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents are those cited in the solicitation or contract.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI S1.15/Part 2 -- Primary Method for Pressure Calibration of Laboratory Standard Microphones by the Reciprocity Technique

(Copies of this document are available on-line at <http://www.ansi.org> or from the ANSI Customer Service Department, 25 W. 43rd Street, 4th Floor, New York, NY 10036.)

ASTM INTERNATIONAL

- ASTM D5948 - Standard Specification for Molding Compounds, Thermosetting (DoD Adopted)

(Copies of this document are available online at <http://www.astm.org> or from the ASTM International, P.O. Box C700, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

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IPC - ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES

J-STD-001 - Requirements for Soldered Electrical and Electronic Assemblies

(Copies of this document are available online at <http://www.ipc.org> or from the IPC - Association Connecting Electronics Industries, 3000 Lakeside Drive, Suite 309 S, Bannockburn, IL 60015-1249.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2 c), a sample shall be subjected to first article inspection in accordance with 4.3.

3.2 Design and construction. Unless otherwise specified (see 3.4), the equipment shall meet with all the applicable requirements of MIL-E-5400, Class I for design and construction.

3.3 Insulating and case materials. Insulating and case materials shall meet the following requirements, as applicable. For information about environmentally preferable materials, see 6.5.

3.3.1 Laminated plastic material. Laminated plastic material shall be in accordance with MIL-I-24768/13, type FBE.

3.3.2 Molded plastic material. Molded plastic material shall be in accordance with ASTM D5948. Type CFG shall be used where electrical properties are predominant. Type CFI-5 shall be used where mechanical properties are predominant.

3.3.3 Case material. Case materials shall be of steel, flame retardant modified polyphenylene oxide or other suitable magnetic shielding material. The earphone shall have a jet black finish except the front magnetic shield. The front magnetic shield shall be protected against corrosion by plating if applicable.

3.3.4 Insulating and impregnating compounds. Under all service conditions and test conditions specified in section 4 of this specification, the compounds including varnishes and waxes shall preserve the dielectric strength of the insulation, to which it is applied. A compound shall not, either in the state of its original application or as a result of aging under severe service conditions, show any injurious effect upon the insulation it is designed to protect, and shall not cause corrosion or deterioration of adjacent metal or plastic parts.

3.3.5 Magnetic materials. The materials used in the magnetic circuit shall be so processed and assembled, that the earphone will not suffer degradation in performance because of loss of magnetization, over long periods of service use or storage.

3.3.6 Cementing compounds. Any cementing compound used in the construction of the earphone shall withstand all service and test conditions outlined in section 4 without evidence of loosening or otherwise affecting the performance requirements of the earphone.

3.3.7 Moisture and fungus-resistant treatment. Earphones shall be fungus proofed by selection of parts and materials as non-nutrient for fungus or the parts and materials shall be treated prior to their use in the earphones.

3.3.8 Interchangeability. The earphones shall meet the interchangeability requirements specified in MIL-E-5400.

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3.3.9 Weight. The weight of each earphone shall be not greater than 2.5 ounces.

3.3.10 Size. Dimensions specified in [figure 1](#), [figure 2](#), and [figure 3](#), including overall size contours, holes, and hole-locations shall be met.

3.3.11 Surface treatment and finishing.

3.3.11.1 Surface treatment. Surface treatment of metal parts shall be in accordance with MIL-DTL-5002.

3.3.11.2 Finishing. Finishing shall be in accordance with MIL-DTL-14072.

3.3.12 Soldering. Only resin, or resin and alcohol, may be used as flux in the assembly of this equipment or any part thereof, except that an acid flux may be used on all metal, nonelectrical subassemblies provided that they are thoroughly and completely cleaned of all traces of the acid immediately after the soldering operation has been completed. Soldering shall be in accordance with J-STD-001, Class 3.

3.3.12.1 Pure tin (see 6.4). The use of pure tin, as an underplate or final finish, is prohibited both internally and externally. Tin content of earphone components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass.

3.3.13 Pressure. The earphones shall be designed such that the equalization of the pressure on both sides of the diaphragm shall take place when the earphone is subjected to changes in ambient pressure down to 3.4 inches of mercury (1.67 PSI).

3.3.14 Explosive decompression. The earphone unit shall be designed so that the unit will show no structural failure or defect and only minor changes in frequency response characteristics (less than 3 dB) as a result of the explosive decompression test (see [4.6.16](#)).

3.3.15 Nomenclature and nameplates. Nomenclature assignment and nameplate approval for equipment identification shall be in accordance with MIL-DTL-18307.

3.4 Performance.

3.4.1 One thousand (1,000) Hz sound pressure output. The normal sea level sound pressure versus frequency characteristics of the earphone shall be 103 ± 2 dB above a reference level of relative to $20 \mu\text{Pa}$ (micro-Pascal) (0.0002 dyne/cm^2) with 1 milliwatt rms power at 2,000 Hz applied to the earphone terminals, when tested in accordance with [4.6.1](#).

3.4.1.1 Sound pressure output versus frequency. The normal sea level sound pressure versus frequency characteristics of each earphone shall not deviate from the 1,000 Hz response by more than the values shown in table I, when tested in accordance with [4.6.1](#).

TABLE I. Deviations of sound pressure versus frequency.

Frequency in Hz	Deviations (in dB)	
	Minimum	Maximum
100 to 2,500	-3	+3
2,501 to 3,000	-3	+3
3,001 to 7,000	-7	+6

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3.4.2 Temperature cycling. The sound pressure versus frequency characteristics of the earphone unit shall not vary more than 3 dB from normal sea level performance at any frequency between 100 and 7,000 Hz after being subjected to 5 temperature cycles ranging between -55 degrees C and +85 degrees C, when tested in accordance with 4.6.2.

3.4.2.1 Temperature extremes. The sound pressure versus frequency characteristics of the earphone unit shall not vary more than 3 dB from normal sea level performance at any frequency between 100 and 7,000 Hz after exposure to temperature of -55 degrees C and +55 degrees C, when tested in accordance with 4.6.3.

3.4.3 Ambient pressure cycling. The sound pressure versus frequency characteristics of the earphone unit shall not vary more than 1 dB from normal sea level performance at any frequency between 100 and 7,000 Hz after being subjected to 5 cycles of ambient pressure ranging between 3.4 and 30 inches of mercury (1.67 to 14.73 PSI), when tested in accordance with 4.6.4.

3.4.3.1 Response at specific ambient pressures. The sound pressures versus frequency characteristics of the earphone unit shall not vary more than 4 dB from normal sea level performance between 100 and 1,000 Hz, when subjected to an ambient pressure of 13.75 inches of mercury (6.75 PSI), nor more than 12 dB at an ambient pressure of 3.4 inches of mercury (1.67 PSI), when tested in accordance with 4.6.5.

3.4.4 Impedance. The impedance of the earphone at 1,000 Hz shall be 15 ± 2 ohms, when tested in accordance with 4.6.6. At any frequency between 100 and 7,000 Hz the impedance shall not vary from the 1,000 Hz value by more than 20 percent (%), when tested in accordance with 4.6.6.

3.4.5 Insulation resistance. The insulation between the winding and the core and between the case and terminal shall withstand 500 volts rms 60-cycle ac without breakdown, when tested in accordance with 4.6.7. The insulation resistance shall exceed 1 megohms between the indicated points, following the application of this voltage.

3.4.6 Distortion. The rms harmonic distortion in the acoustic output of the earphone shall not exceed 2.5 percent (%) at any fundamental frequency between 200 and 7,000 Hz, when tested in accordance with 4.6.8.

3.4.7 Overload. The design of the earphone unit shall be such that the unit shall show no structural failure or defect and only minor changes in frequency response characteristics (less than 3 dB) as a result of the overload test (see 4.6.9).

3.5 Environmental.

3.5.1 Humidity. The sound pressure versus frequency characteristics of the earphone unit shall not vary more than 6 dB from normal sea level performance at any frequency between 100 and 7,000 Hz, when tested in accordance with the humidity test of 4.6.10.

3.5.2 Moisture. The sound pressure versus frequency characteristics of the earphone unit shall not vary more than 3 dB from normal sea level performance at any frequency between 100 and 7,000 Hz following exposure to the moisture resistance test (see 4.6.11).

3.5.3 Salt spray. The sound pressure versus frequency characteristics of the earphone unit shall not vary more than 3 dB from normal sea level performance at any frequency between 100 and 7,000 Hz after drying following exposure to the salt spray test (see 4.6.12).

3.5.4 Impact. The sound pressure versus frequency characteristics of the earphone unit shall not vary more than 3 dB from normal sea level performance at any frequency between 100 and 7,000 Hz and no structural failure shall be evidenced after 12 drops at random (see 4.6.13).

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3.5.5 Electromagnetic interference. The electromagnetic interference of the earphone shall cause no more than a 5 degrees deflection of a magnetic compass, when tested in accordance with 4.6.14.

3.5.6 Aging. The earphone unit shall be such that the unit will show no structural failure or defect and only minor changes (less than 1 dB) in frequency response characteristics as a result of the aging test (see 4.6.15).

3.6 Nomenclature and nameplates. Nomenclature assignment and nameplate approval for equipment identification shall be in accordance with MIL-DTL-18307.

3.7 Workmanship. Workmanship, fabrications, and manufacturing processes shall conform to the requirements of MIL-E-5400. Particular attention shall be paid to neatness and thoroughness of soldering, wiring, impregnation of coils, plating, staking, riveting, and machine screw assemblage. All dimensions and tolerances not specified on the applicable drawings shall be held as close as is consistent with the best shop practice. Where dimensions and tolerances affect the interchangeability, operation, or performance of the earphone, they shall be held or limited accordingly. All units shall be inspected for loose, spattered, or excess solder. Metal chips and other foreign material, if found to be present, shall be removed prior to final assembly.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the applicable test method document or applicable paragraphs of this specification.

4.3 First article inspection. shall be performed at a laboratory acceptable to the Government on sample units produced with equipment and procedures normally used in production. The first article inspection sample shall consist of 10 (ten) items of each manufacturer's part number for which approval is desired. The first article inspection shall consist of all the tests of this specification, in accordance with 4.6. Contractors not having laboratory testing facilities satisfactory to the Government for sampling tests shall engage the services of a commercial testing laboratory acceptable to the following US Navy facility, which is responsible for both approval of the first article testing laboratory and evaluation of the first article test (FAT) report:

Commanding Officer
Human Systems Department Code 4.6.7.4
48110 Shaw Road Unit 5
BLDG 2187 Suite 1240-G8
NAWCAD Patuxent River, MD 20670

Following completion, the FAT report and items under test must be separately packaged and forwarded to the activity responsible for FAT report evaluation and approval, as designated in the letter of authorization. The sample shall in all respects be representative of the manufacturer's production item. Each of the 10 (ten) items shall be subjected to the applicable inspections specified in this specification. Samples shall be plainly identified by securely attached durable tags marked with the following information.

- a. Sample for first article test.
- b. Specification.
- c. Nomenclature.
- d. Military Part or Identifying Number (PIN).

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- e. Manufacturer's part number.
- f. Name of manufacturer.
- g. Submitted (date under authorization of reference letter authorizing the test).

4.3.1 First article inspection routine. The sample shall be subjected to the inspections specified in [table III](#), in the order shown. All sample units shall be subjected to the inspections of groups A, B and C.

4.3.2 Failures. One or more failures shall be cause for refusal to grant first article approval.

4.4 Conformance inspections. The acceptance or approval of material during course of manufacturing shall in no case be construed as a guarantee of the acceptance of the finished product. Acceptance of the finished product shall be upon a lot basis after satisfactory completion of all required tests.

4.4.1 Inspection lot. An inspection lot shall consist of all earphones produced under essentially the same conditions and presented for inspection and test at the same time. The unit of inspection shall be one earphone.

4.4.2 Group A inspection. Group A inspection shall consist of the inspections specified in [table III](#). All earphones shall be inspected.

4.4.3 Group B inspection. Group B inspection shall consist of the inspections specified in [table III](#) and shall be made on sample units which have been subjected to and have passed Group A inspection.

4.4.3.1 Sampling plan for Group B inspection. The sampling plan shall be in accordance with [table II](#). If one or more sample fails, the lot is rejected. Contracts for less than 10 (ten) earphones shall be subject to 100 percent inspection.

TABLE II. Sampling plan for Group B inspection.

Number earphone assemblies in contract	Total number of earphones to be tested
10 thru 280	3
281 thru 500	6
501 thru 1000	9
1001 thru 2000	12
2001 thru 5000	15
5001 or more	18

4.4.4 Group C tests. Four (4) random samples shall be selected from each inspection lot and subjected to Group C tests. If one sample fails the lot is rejected. Separate samples shall be used for the overload, temperature cycling, and explosive decompression tests. The same sample shall be used for the salt spray and impact tests. The impact test shall be performed after completion of the salt spray test.

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Inspection	Requirement paragraph	Test paragraph
Group A		
Insulation resistance	3.4.5	4.6.7
Workmanship	3.7	4.6.17
Group B		
Sound pressure output vs. frequency	3.4.1.1	4.6.1
Temperature extremes	3.4.2.1	4.6.3
Ambient pressure cycling	3.4.3	4.6.4
Response at specific ambient pressures	3.4.3.1	4.6.5
Impedance	3.4.4	4.6.6
Distortion	3.4.6	4.6.8
Electromagnetic interference	3.5.5	4.6.14
Aging	3.5.6	4.6.15
Group C		
Temperature cycling	3.4.2	4.6.2
Overload	3.4.7	4.6.9
Humidity	3.5.1	4.6.10
Moisture	3.5.2	4.6.11
Salt spray	3.5.3	4.6.12
Impact	3.5.4	4.6.13
Explosive decompression	3.3.14	4.6.16

4.4.5 Resubmitted inspection lots. A resubmitted inspection lot shall be inspected by the contractor under supervision of the Government inspector. Before resubmitting, full particulars concerning the cause of previous rejection and the action taken to correct the defects found in the inspection lot shall be furnished by the contractor to the responsible contracting office.

4.5 Test conditions. All tests specified herein shall be made under the following ambient conditions except as otherwise required in specific test requirements.

- a. Temperature: +25 degrees, with (\pm) tolerances of +15 degrees C and -5 degrees C.
- b. Pressure: 28 to 30 inches of mercury (13.75 to 14.73 PSI).
- c. Humidity: 15 to 90 percent relative.

4.5.1 Tolerances. Where specific tolerances are not given, the maximum allowable tolerances on test condition measurements shall be as follows:

- a. Temperature: \pm 2.0 degrees C
- b. Altitude: \pm 5 percent in feet
- c. Humidity: \pm 5 percent relative
- d. Vibration amplitude: \pm 5 percent. This tolerance is applicable only to the amplitude measuring instruments.
- e. Vibration frequency: \pm 2 percent. This tolerance is applicable only to the frequency measuring instruments.

4.5.2 Test equipment. All instruments used in performing the measurements required by this specification shall be subject to the approval of the procuring activity.

4.5.2.1 Special requirement for sound pressure output test equipment. All tests for sound pressure output versus frequency characteristics shall be made using test equipment in accordance with ANSI S1.15/Part 2 or as directed by the procuring activity.

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4.5.2.2 Microphone. The standard microphone used for making sound pressure output versus frequency tests shall be calibrated in accordance with ANSI S1.15/Part 2 within 3 months prior to the start of each contract covered by this specification and at least every 6 months during each contract.

4.5.2.3 Audio oscillator. The audio oscillator shall have a frequency range of at least 100 to 10,000 Hz, shall be stable in both output voltage and frequency, and shall have a waveform distortion of less than 0.5 percent.

4.5.2.4 Voltmeter. The voltmeters used shall have flat frequency response (± 0.2 dB) from at least 100 to 10,000 Hz, and shall measure voltages from 0.001 volt rms to 10 volts or more.

4.5.2.5 Microphone preamplifier. The microphone preamplifier shall have a flat response (± 1 dB) over a frequency range of at least 100 to 10,000 Hz, shall have a high degree of stability and shall have distortion of less than 1 percent.

4.5.2.6 Wave analyzer. The wave analyzer shall have a frequency range of at least 100 to 10,000 Hz, and shall have a high selectivity and a voltage range from 0.001 to 10 volts.

4.6 Tests.

4.6.1 Sound pressure output versus frequency (see 4.3). Measurements shall be made, as follows using the test apparatus specified and calibrated in accordance with 4.5.2:

- a. Connect the earphone under test to the test circuit and mount on the 6 cubic centimeters (cc) coupler, as shown on figure 4. Figure 5 gives information on the 6 cc coupler.
- b. Adjust the output from the oscillator to 0.245 volts at 1,000 Hz, as measured by the voltmeter (see figure 4).
- c. Measure the output from the calibrated microphone and preamplifier unit, as indicated by the reading of the voltmeter (see figure 4), and convert this reading to the equivalent dB value above 20 micropascals μPA [0.0002 dyne/cm²] using the most recent available calibration curve for the test microphone in use.
- d. Repeat the operations set forth in 4.6.1 b and 4.6.1 c for each of the following frequencies:
 - (1) From 100 Hz to 1,000 inclusive, measure at each increment of 100 Hz.
 - (2) From 1,250 Hz to 7,000 Hz inclusive, measure at each increment of 250 Hz.
- e. The results obtained in 4.6.1 c and 4.6.1 d shall be plotted on semi log graph paper before forwarding to the procuring activity. Use an ordinate scale reading from 80 to 140 dB above 20 μPA [0.0002 dyne/cm²] and an abscissa scale reading from 100 to 10,000 Hz inclusive.

4.6.2 Temperature cycling. The ambient temperature cycling shall be in accordance with MIL-STD-202, method 107, using test condition A of table 107-1. The earphone shall meet the requirements of 3.4.2.

4.6.3 Temperature extremes. The sound pressure output versus frequency characteristics of the earphone under test shall be measured using the procedures set forth in 4.6.1, with the earphone subjected to the contractor's options. The tests specified shall be made at room temperature following exposure of at least 1 hour to the specific temperature extremes provided that all tests are completed within 10 minutes after removal from the temperature chamber. The earphone shall meet the requirements of 3.4.2.1.

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4.6.4 Ambient pressure cycling. Ambient pressure cycling shall consist of varying the ambient pressure surrounding the earphone under test as follows:

- a. Reduce the ambient pressure from normal room pressure to 3.4 inches of mercury (1.67 PSI).
- b. Retain the ambient pressure at between 3.0 (1.47 PSI) and 3.4 inches of mercury for 5 minutes.
- c. Increase the ambient pressure to normal room pressure (14.7 PSI) at a rate of from 0.45 to 0.55 inch of mercury (0.015 to 0.018 PSI) per second.
- d. Retain the ambient pressure at normal room pressure for 5 minutes.
- e. Repeat the procedure set forth in 4.6.4 a thru 4.6.4 d inclusive, until the earphone has been subjected to 5 complete cycles.
- f. Measure the sound pressure output versus frequency characteristics of the earphone as described in 4.6.1. The earphone shall meet the requirements of 3.4.3.

4.6.5 Response at specific ambient pressures. Measure the sound pressure output versus frequency characteristics of the earphone under test using the procedures set forth in 4.6.1 with the earphones subjected to the ambient pressures specified in 3.4.3. The earphone shall meet the requirements of 3.4.3.1.

4.6.6 Impedance. Impedance measurement shall be made at 1,000 Hz with the earphones mounted on the 6 cc coupler as shown on figure 4, using a voltmeter-ammeter circuit satisfactory to the responsible Government inspector. The 1,000 Hz voltage applied across the terminals of the earphone during impedance measurements shall be 0.245 volts rms.

4.6.7 Insulation resistance. The insulation resistance of each earphone shall be measured from one insulated terminal to the clamping ring or other metallic surface not covered by a non-conducting coating which has good contact to the case of the headphone. The test shall use any standard ohmmeter circuit which is designed to apply at least 500 volts dc across the test terminals during the measurement. A 500 volts megger resistance test may be substituted for the 500 volt dc test described above, at the option of the contractor. The earphone shall meet the requirements of 3.4.5.

4.6.8 Distortion (see 3.4.6). Measurements shall be made using the test apparatus specified and calibrated in accordance with 4.5.2, as follows:

- a. Connect the earphone under test to the test circuit and mount on the 6 cc coupler as shown in figure 4.
- b. Adjust the output from the oscillator to 2.12 volts rms at 200 Hz as measured by the voltmeter (see figure 4).
- c. With the wave analyzer input connected across the voltmeter (see figure 4) and operated according to manufacturer's instructions, measure the rms harmonic distortion as computed from the following formula:

$$\text{"PERCENT DISTORTION"} = 100 \times \sqrt{\frac{P_2^2 + P_3^2 + \dots + P_n^2}{P_1^2 + P_2^2 + P_3^2 + \dots + P_n^2}} \text{ "}$$

Where:

P_1 is the sound pressure output at the oscillator (fundamental frequency).

P_2, P_3, \dots , are the sound pressure outputs of each respective harmonic frequency having measured output in excess of 10 percent of the output at the fundamental frequency.

- d. Repeat the operations set forth in 4.6.8 b and 4.6.8 c using an oscillator frequency of 400 Hz and such additional frequencies between 400 and 7,000 Hz, as are required to determine at what frequency in this range maximum distortion exists.

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4.6.9 Overload (see 3.4.7). Audio power of 500 milliwatts rms at 1,000 Hz shall be applied to each earphone under test for 8 hours. During the last hour of test, the earphone shall be checked for audible rattles or other signs of failure. Upon completion of the overload period, the sound pressure output versus frequency characteristics shall be measured as set forth in 4.6.1.

4.6.10 Humidity. The earphone shall be exposed to 95 percent relative humidity at 50 degrees C for 24 hours and shall not vary more than 3 dB when tested after drying. The earphone shall meet the requirements of 3.5.1.

4.6.11 Moisture. Each earphone under this test shall be subjected to moisture resistance test conditions in accordance with MIL-STD-202, method 106. The earphone shall meet the requirements of 3.5.2.

4.6.12 Salt spray. Each earphone under test shall be subjected to salt spray in accordance with MIL-STD-202, method 101, test condition B. The sound pressure output versus frequency characteristics shall be measured as specified in 4.6.1. The earphone shall meet the requirements of 3.5.3.

4.6.13 Impact. Each earphone under test shall be dropped 12 times at random from a height of 3 feet onto a concrete floor or block, then the sound pressure output versus frequency characteristics shall be measured as specified in 4.6.1. The earphone shall meet the requirements of 3.5.4.

4.6.14 Electromagnetic interference. Electromagnetic interference measurements shall be made in a shielded room or in an area proved, to the satisfaction of the responsible Government inspector, to be free from appreciable magnetic disturbances. The earphone under test shall be rotated on its axis at various points on the surface of an 8 inch radius sphere surrounding a compass which meets the requirements of A-A-52024. The earphone shall meet the requirements of 3.5.5.

4.6.15 Resistance to aging. Each earphone under test shall be tested as follows:

- a. Place the earphone with its diaphragm in a vertical plane on a standard vibrating machine which has an amplitude of 0.06 inch in such a manner as to provide, individually, motion in three directions (perpendicular, parallel, and 45 degrees to perpendicular) relative to the axis of the earphone which is perpendicular to the diaphragm.
- b. Apply audio power of 60 milliwatts rms at 1,000 Hz to the earphone for intervals of 2 minutes on and 2 minutes off.
- c. Vary the frequency of the vibrating machine approximately every minute from 10 to 50 to 10 Hz.
- d. After a one hour period of the tests described in 4.6.15 b and 4.6.15 c above, measure the sound pressure output versus frequency characteristics of the earphone as described in 4.6.1. The earphone shall meet the requirements of 3.5.6.

4.6.16 Explosive decompression. Each earphone under test shall be subjected to 10 consecutive explosive decompressions from an altitude of 8,000 feet to an altitude of 35,000 feet (corresponding to pressure of 22.5 to 7.04 inches of mercury or 11.05 to 3.46 PSI). Each complete decompression or change of pressure shall take place in 0.1 seconds or less. The impedance at 1,000 Hz and the sound pressure output versus frequency characteristics shall be measured before and after completion of the test as specified in 4.6.1. The earphone shall meet the requirements of 3.3.14.

4.6.17 Workmanship. Each earphone shall be visually inspected to insure that:

- a. The earphone sections are tightly clamped or otherwise properly fastened together in accordance with the first article test sample.
- b. All external finishes, including any plated parts, shall be free from blemishes, which would permit breaking of the protective coating.
- c. All markings shall be complete and in accordance with an approved sample and figure 1, figure 2, and figure 3.
- d. The color of the case shall be in accordance with an approved sample.

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- e. The weight and overall dimensions shall be correct, by comparison with an approved sample or [figure 1](#), [figure 2](#), and [figure 3](#), and insertion in an approved fixture.
- f. Both cord connector set screws shall be in place and turn freely in the terminal lug.
- g. The holes in the face of the unit shall be cut clean, properly centered and free from foreign materials, of any kind.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see [6.2 d](#)). When actual packaging of material is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. These earphones are intended for use with a variety of headsets and helmets required for aircraft communicating facilities in performance of the function intended (see [3.4](#)). They are used with cord assembly P/O H-87B/U, as specified in MIL-DTL-18266, which is designed to provide electrical connections between earphone H-87B/U and inter-communication and/or radio facilities.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of the specification.
- b. Type of earphone (see [1.2](#)).
- c. When first article inspection is required (see [3.1](#)).
- d. Packaging requirements (see [5.1](#)).

6.3 Subject term (key word) listing.

Acoustical energy
Dynamic type
Electromagnetic interference
Frequency response characteristics
Harmonic distortion
Moving coil
Sound pressure

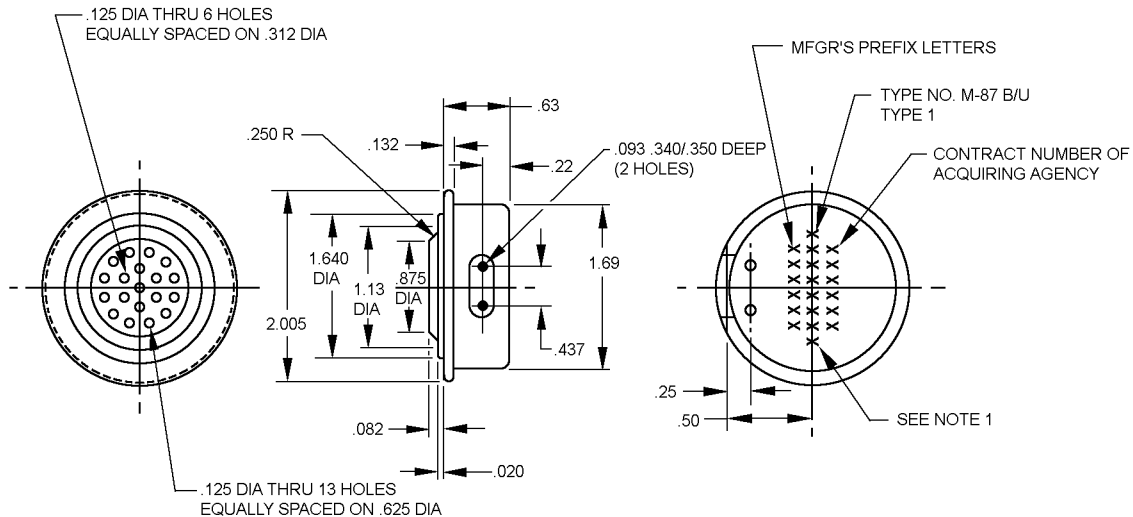
6.4 Tin whisker growth (see [3.3.12.1](#)). The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers. For additional information on this matter, refer to ASTM B545 (Standard Specification for Electrodeposited Coatings of Tin).

6.5 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmental Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The

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list of chemicals and additional information is available on their website <http://www.epa.gov/osw/hazard/wastemin/priority.htm>. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see 3.3).

6.6 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content, irrespective of the marginal notations.

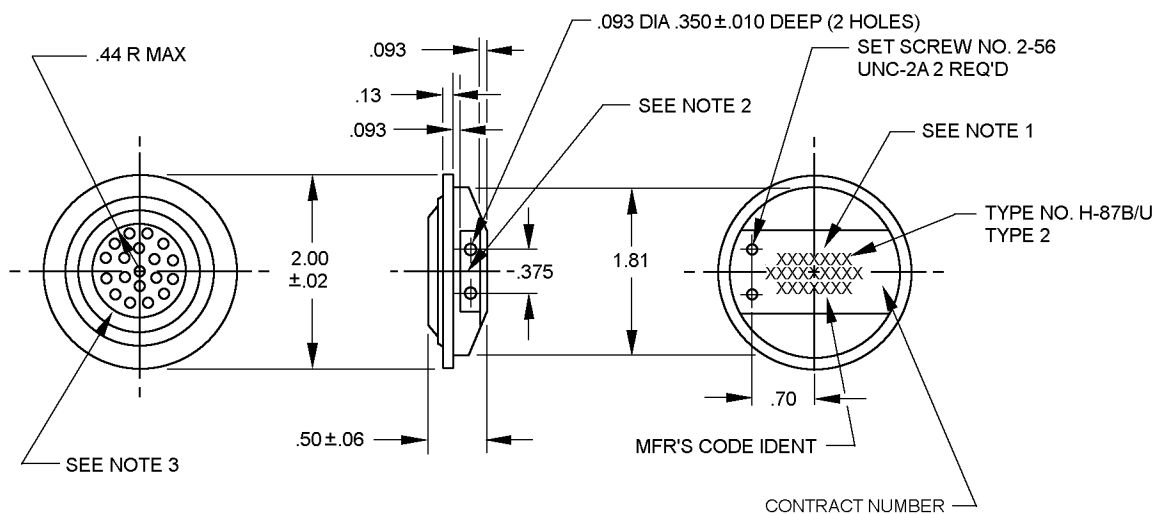


Inches	mm	Inches	mm	Inches	mm
0.020	0.51	0.312	7.92	0.875	22.23
0.082	2.08	0.340	8.64	1.130	28.70
0.093	2.36	0.350	8.89	1.640	41.66
0.125	3.18	0.437	11.10	1.690	42.93
0.132	3.35	0.500	12.70	2.005	50.93
0.220	5.59	0.625	15.88		
0.250	6.35	0.630	16.00		

NOTES:

1. Characters shall be .093 inches high and shall be impressed permanently.
2. Dimensions are in inches. Tolerances are: 2 place decimals ± 0.015 (0.38 mm), 3 place decimals ± 0.005 (0.13 mm)
3. Metric equivalents are given for information only and are based upon 1 inch = 25.4 mm.

FIGURE 1. Earphone – type 1.

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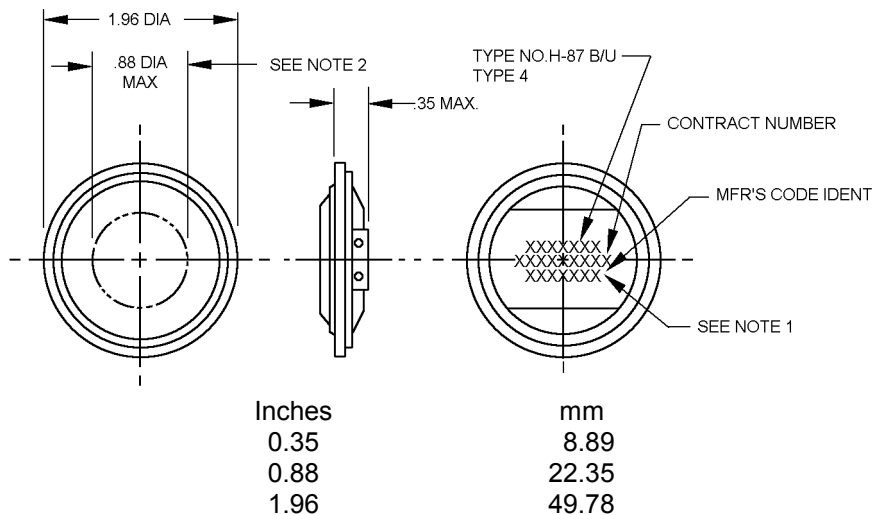
Inches	mm	Inches	mm	Inches	mm
0.010	0.25	0.130	3.30	0.500	12.70
0.020	0.51	0.350	8.89	0.700	17.78
0.060	1.52	0.375	9.51	1.810	45.97
0.093	2.36	0.440	11.18	2.000	50.80

NOTES:

1. Characters shall be .093 inch high and impressed permanently into case.
2. Connection holes may be located within envelope shown.
3. Size, number, and location of holes in cap to be determined by manufacturer, subject to acoustical and electrical requirements and limiting dimensions.
4. Earphone configuration may vary from that shown but dimensions shall not be exceeded. Mounting dimensions shall be as specified.
5. Dimensions are in inches, tolerances are 2 place decimals ± 0.015 (0.38 mm), 3 place decimals ± 0.005 (0.13 mm).
6. Metric equivalents are given for information only and are based upon 1 inch = 25.4 mm.

FIGURE 2. Earphone – type 2.

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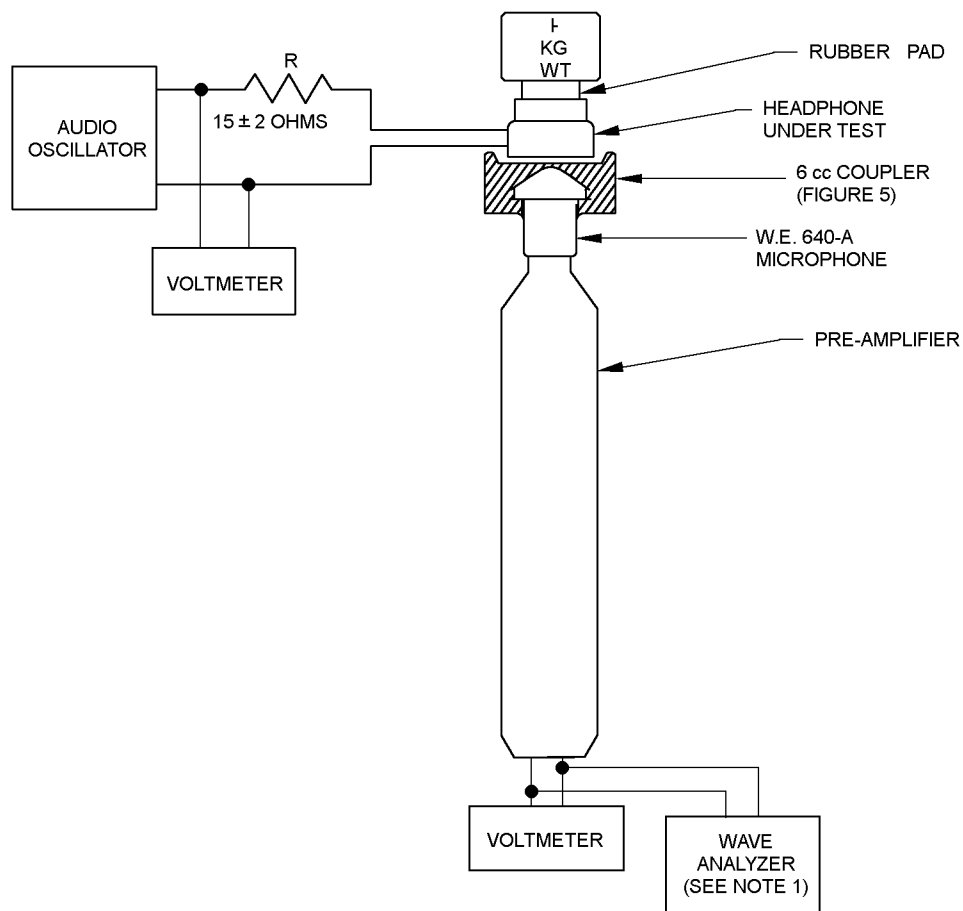


NOTES:

1. Characters shall be .093 inch (2.36 mm) high and impressed into cap.
2. Size, number, and location of holes in cap to be determined by manufacturer, subject to acoustical and electrical requirements and limiting dimensions.
3. Dimensions are in inches. Tolerances are 2 place decimals ± 0.015 (0.38 mm), 3 place decimals ± 0.005 (0.13 mm) unless otherwise noted.
4. Metric equivalents are given for information only and are based upon 1 inch = 25.4 mm.

FIGURE 3. Earphone – type 4.

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NOTES:

1. Wave analyzer required for distortion tests only.
2. The essential characteristics for components shown in this figure are specified herein (see 4.5.2).

FIGURE 4. Test circuit.

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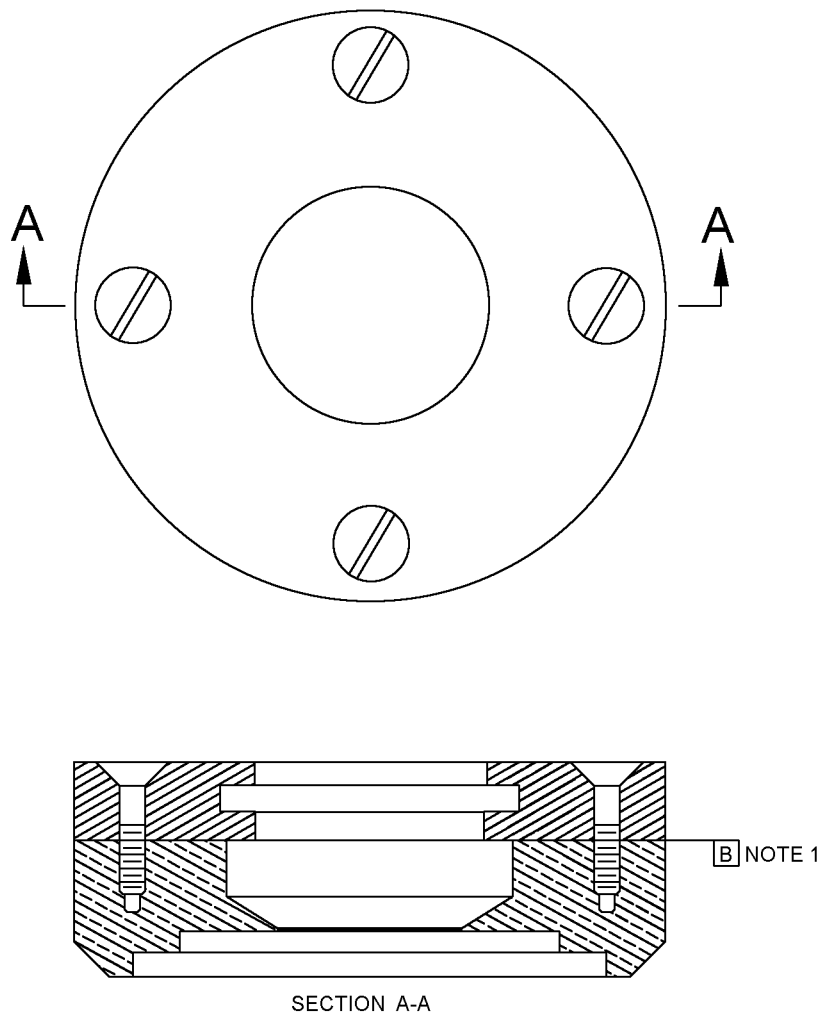
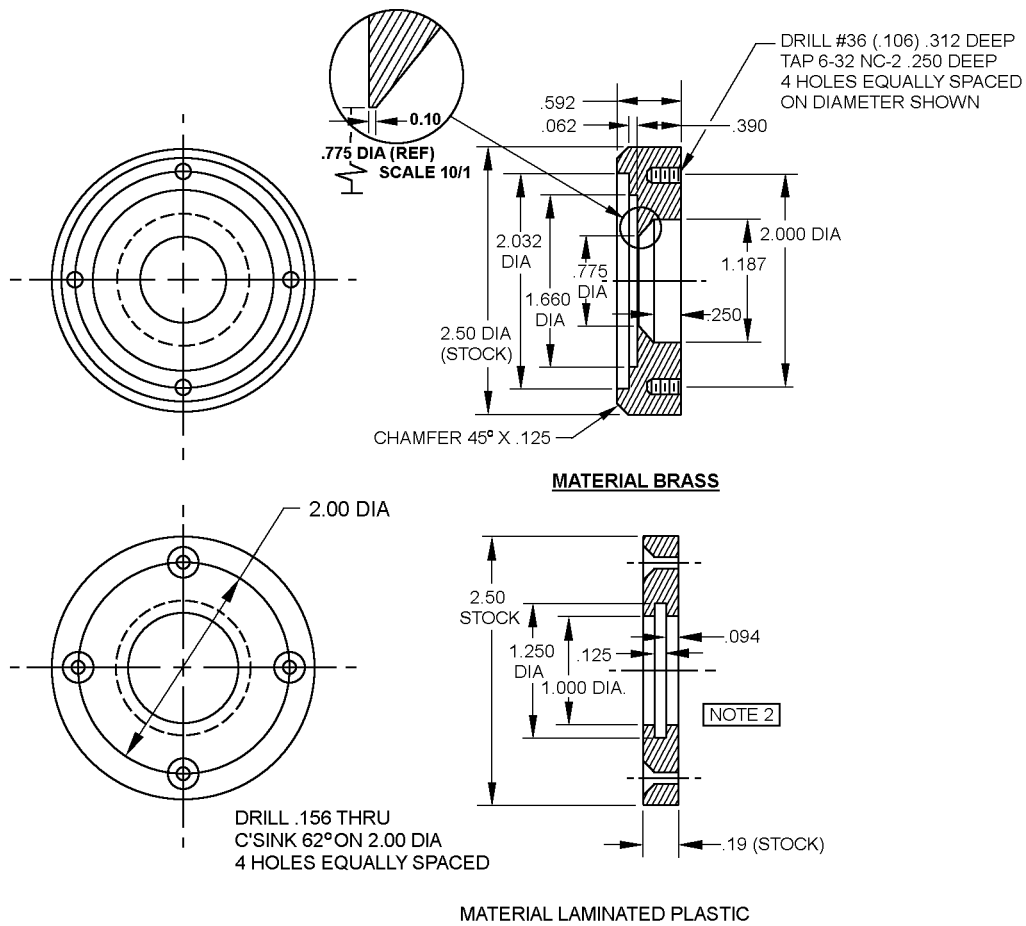


FIGURE 5. Coupler, acoustic 6 cc.

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Inches	mm	Inches	mm	Inches	mm	Inches	mm
0.062	1.57	0.156	3.96	0.592	15.04	1.660	42.16
0.094	2.39	0.190	4.83	0.775	19.69	2.000	50.80
0.100	2.54	0.250	6.35	1.000	25.40	2.032	51.61
0.125	3.18	0.312	7.92	1.250	31.75	2.500	63.50

NOTES:

1. The test microphone grid lies in the plane "B" (see coupler section A – A on previous page).
2. Diameter 1.250 is for rubber gasket.
3. Dimensions are in inches, tolerances are 2 place decimals ± 0.015 (0.38 mm), 3 place decimals ± 0.005 (0.13 mm), and angles ± 2 degrees.
4. Metric equivalents are given for information only and are based upon 1 inch = 25.4 mm.

FIGURE 5. Coupler, acoustic 6 cc – Continued.

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CONCLUDING MATERIAL

Custodians:
Navy - AS
DLA - CC

Preparing activity:
Navy – AS

Agent:
DLA-CC

(Project 5965-2013-020)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.